

11-21-00

A

11/20/00  
1c960 U.S. PTO

Practitioner's Docket No. 460-009934-US(PAR)

PATENT

Preliminary Classification:

Proposed Class:

Subclass:

NOTE: "All applicants are requested to include a preliminary classification on newly filed patent applications. The preliminary classification, preferably class and subclass designations, should be identified in the upper right-hand corner of the letter of transmittal accompanying the application papers, for example 'Proposed Class 2, subclass 129.'" M.P.E.P. § 601, 7th ed.

1c862 U.S. PTO  
09/16880  
00/02/11

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Box Patent Application  
Assistant Commissioner for Patents  
Washington, D.C. 20231

NEW APPLICATION TRANSMITTAL

Transmitted herewith for filing is the patent application of

Inventor(s): Markku LIPPONEN, Ari AHO

WARNING: 37 C.F.R. § 1.41(a)(1) points out:

"(a) A patent is applied for in the name or names of the actual inventor or inventors.

"(1) The inventorship of a nonprovisional application is that inventorship set forth in the oath or declaration as prescribed by § 1.63, except as provided for in § 1.53(d)(4) and § 1.63(d). If an oath or declaration as prescribed by § 1.63 is not filed during the pendency of a nonprovisional application, the inventorship is that inventorship set forth in the application papers filed pursuant to § 1.53(b), unless a petition under this paragraph accompanied by the fee set forth in § 1.17(i) is filed supplying or changing the name or names of the inventor or inventors."

For (title): ELECTRONIC DEVICE AND A METHOD IN AN ELECTRONIC DEVICE

CERTIFICATION UNDER 37 C.F.R. § 1.10\*  
(Express Mail label number is mandatory.)  
(Express Mail certification is optional.)

I hereby certify that this New Application Transmittal and the documents referred to as attached therein are being deposited with the United States Postal Service on this date 20 November 2000, in an envelope as "Express Mail Post Office to Addressee," mailing Label Number EL627420983US, addressed to the: Assistant Commissioner for Patents, Washington, D.C. 20231.

Deborah J. Clark

(type or print name of person mailing paper)

Deborah J. Clark  
Signature of person mailing paper

WARNING: Certificate of mailing (first class) or facsimile transmission procedures of 37 C.F.R. § 1.8 cannot be used to obtain a date of mailing or transmission for this correspondence.

\*WARNING: Each paper or fee filed by "Express Mail" must have the number of the "Express Mail" mailing label placed thereon prior to mailing. 37 C.F.R. § 1.10(b).

"Since the filing of correspondence under § 1.10 without the Express Mail mailing label thereon is an oversight that can be avoided by the exercise of reasonable care, requests for waiver of this requirement will not be granted on petition." Notice of Oct. 24, 1996, 60 Fed. Reg. 56,439, at 56,442.

(New Application Transmittal [4-1]—page 1 of 11)

09716880 112000

Parameter	Value	Unit
Initial concentration	1.0	g/L
Initial pH	7.0	
Temperature	25	°C
Time	0, 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048, 4096, 8192, 16384, 32768, 65536, 131072, 262144, 524288, 1048576, 2097152, 4194304, 8388608, 16777216, 33554432, 67108864, 134217728, 268435456, 536870912, 1073741824, 2147483648, 4294967296, 8589934592, 17179869184, 34359738368, 68719476736, 137438953472, 274877906944, 549755813888, 1099511627776, 2199023255552, 4398046511104, 8796093022208, 17592186044416, 35184372088832, 70368744177664, 140737488355328, 281474976710656, 562949953421312, 1125899906842624, 2251799813685248, 4503599627370496, 9007199254740992, 18014398509481984, 36028797018963968, 72057594037927936, 144115188075855872, 288230376151711744, 576460752303423488, 1152921504606846976, 2305843009213693952, 4611686018427387904, 9223372036854775808, 18446744073709551616, 36893488147419103232, 73786976294838206464, 147573952589676412928, 295147905179352825856, 590295810358705651712, 1180591620717411303424, 2361183241434822606848, 4722366482869645213696, 9444732965739290427392, 18889465931478580854784, 37778931862957161709568, 75557863725914323419136, 151115727451828646838272, 302231454903657293676544, 604462909807314587353088, 1208925819614629174706176, 2417851639229258349412352, 4835703278458516698824704, 9671406556917033397649408, 19342813113834066795298816, 38685626227668133590597632, 77371252455336267181195264, 154742504910672534362390528, 309485009821345068724781056, 618970019642690137449562112, 1237940039285380274899124224, 2475880078570760549798248448, 4951760157141521099596496896, 9903520314283042199192993792, 19807040628566084398385987584, 39614081257132168796771975168, 79228162514264337593543950336, 158456325028528675187087900672, 316912650057057350374175801344, 633825300114114700748351602688, 1267650600228229401496703205376, 2535301200456458802993406410752, 5070602400912917605986812821504, 10141204801825835211973625643008, 20282409603651670423947251286016, 40564819207303340847894502572032, 81129638414606681695789005144064, 162259276829213363391578010288128, 324518553658426726783156020576256, 649037107316853453566312041152512, 1298074214633706907132624082305024, 2596148429267413814265248164610048, 5192296858534827628530496329220096, 10384593717069655257060992658440192, 20769187434139310514121985316880384, 41538374868278621028243970633760768, 83076749736557242056487941267521536, 166153499473114484112975882535043072, 332306998946228968225951765070086144, 664613997892457936451903530140172288, 1329227995784915872903807060280344576, 2658455991569831745807614120560689152, 5316911983139663491615228241121378304, 10633823966279326983230456482242756608, 21267647932558653966460912964485513216, 42535295865117307932921825928971026432, 85070591730234615865843651857942052864, 170141183460469231731687303715884105728, 340282366920938463463374607431768211456, 680564733841876926926749214863536422912, 1361129467683753853853498429727072845824, 2722258935367507707706996859454145691648, 5444517870735015415413993718908291383296, 10889035741470030830827987437816582766592, 21778071482940061661655974875633165533184, 43556142965880123323311949751266331066368, 87112285931760246646623899502532662132736, 174224571863520493293247799005065324265472, 348449143727040986586495598010130648530944, 696898287454081973172991196020261297061888, 1393796574908163946345982392040522594123776, 2787593149816327892691964784081045188247552, 5575186299632655785383929568162090376495104, 11150372599265311570767859136324180752990208, 22300745198530623141535718272648361505980416, 44601490397061246283071436545296723011960832, 89202980794122492566142873090593446023921664, 178405961588244985132285746181186892047843328, 356811923176489970264571492362373784095686656, 713623846352979940529142984724747568191373312, 1427247692705959881058285969449495136382746624, 2854495385411919762116571938898990272765493248, 5708990770823839524233143877797980545530986496, 11417981541647679048466287755595961091061972992, 2283596308329	

*(check one applicable item below)*

- WARNING:** Do not use this transmittal for a completion in the U.S. of an International Application under 35 U.S.C. § 371(c)(4), unless the International Application is being filed as a divisional, continuation or continuation-in-part application.

**NOTE:** If one of the following 3 items apply, then complete and attach ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF A PRIOR U.S. APPLICATION CLAIMED and a NOTIFICATION IN PARENT APPLICATION OF THE FILING OF THIS CONTINUATION APPLICATION.

- 2. Benefit of Prior U.S. Application(s) (35 U.S.C. §§ 119(e), 120, or 121)**

**37 C.F.R. § 1.78(a)(1).**

**WARNING:** *If an application claims the benefit of the filing date of an earlier filed application under 35 U.S.C. §§ 120, 121 or 365(c), the 20-year term of that application will be based upon the filing date of the earliest U.S. application that the application makes reference to under 35 U.S.C. §§ 120, 121 or 365(c). (35 U.S.C. § 154(a)(2) does not take into account, for the determination of the patent term, any application on which priority is claimed under 35 U.S.C. §§ 119, 365(a) or 365(b).) For a c-i-p application, applicant should review whether any claim in the patent that will issue is supported by an earlier application and, if not, the applicant should consider canceling the reference to the earlier filed application. The term of a patent is not based on a claim-by-claim approach. See Notice of April 14, 1995, 60 Fed. Reg. 20,195, at 20,205.*

(New Application Transmittal [4-1]—page 2 of 11)

☐ The new application being transmitted claims the benefit of prior U.S. application(s). Enclosed are ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

- ☐ Declaration of Biological Deposit
- ☐ Submission of "Sequence Listing," computer readable copy and/or amendment pertaining thereto for biotechnology invention containing nucleotide and/or amino acid sequence.
- ☐ Authorization of Attorney(s) to Accept and Follow Instructions from Representative
- ☐ Special Comments
- ☐ Other

**5. Declaration or oath (including power of attorney)**

**NOTE:** A newly executed declaration is not required in a continuation or divisional application provided that the prior nonprovisional application contained a declaration as required, the application being filed is by all or fewer than all the inventors named in the prior application, there is no new matter in the application being filed, and a copy of the executed declaration filed in the prior application (showing the signature or an indication thereon that it was signed) is submitted. The copy must be accompanied by a statement requesting deletion of the names of person(s) who are not inventors of the application being filed. If the declaration in the prior application was filed under § 1.47, then a copy of that declaration must be filed accompanied by a copy of the decision granting § 1.47 status or, if a nonsigning person under § 1.47 has subsequently joined in a prior application, then a copy of the subsequently executed declaration must be filed. See 37 C.F.R. §§ 1.63(d)(1)-(3).

**NOTE:** A declaration filed to complete an application must be executed, identify the specification to which it is directed, identify each inventor by full name including family name and at least one given name, without abbreviation together with any other given name or initial, and the residence, post office address and country or citizenship of each inventor, and state whether the inventor is a sole or joint inventor. 37 C.F.R. § 1.63(a)(1)-(4).

☐ Enclosed

Executed by

(check all applicable boxes)

- ☐ Inventor(s).
- ☐ legal representative of inventor(s).  
37 C.F.R. §§ 1.42 or 1.43.
- ☐ joint inventor or person showing a proprietary interest on behalf of inventor who refused to sign or cannot be reached.

☐ This is the petition required by 37 C.F.R. § 1.47 and the statement required by 37 C.F.R. § 1.47 is also attached. See Item 13 below for fee.

☒ Not Enclosed.

**NOTE:** Where the filing is a completion in the U.S. of an International Application or where the completion of the U.S. application contains subject matter in addition to the International Application, the application may be treated as a continuation or continuation-in-part, as the case may be, utilizing ADDED PAGE FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION CLAIMED.

☒ Application is made by a person authorized under 37 C.F.R. § 1.41(c) on behalf of all the above named inventor(s).

(The declaration or oath, along with the surcharge required by 37 C.F.R. § 1.16(e) can be filed subsequently).

☐ Showing that the filing is authorized.  
(not required unless called into question. 37 C.F.R. § 1.41(d))

The inventorship for all the claims in this application are:

- or**

- (New Application Transmittal [4-1]—page 5 of 11)

**9. Certified Copy**

Certified copy(ies) of application(s)

Country	Appln. No.	Filed
Finland	19992510	24 November 1999
Country	Appln. No.	Filed
Country	Appln. No.	Filed

from which priority is claimed

- ☒ Is (are) attached.  
☐ will follow.

NOTE: The foreign application forming the basis for the claim for priority must be referred to in the oath or declaration. 37 C.F.R. § 1.55(a) and 1.63.

NOTE: This item is for any foreign priority for which the application being filed directly relates. If any parent U.S. application or International Application from which this application claims benefit under 35 U.S.C. § 120 is itself entitled to priority from a prior foreign application, then complete Item 18 on the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

**10. Fee Calculation (37 C.F.R. § 1.16)**

A. ☒ Regular application

CLAIMS AS FILED						
Number filed			Number Extra	Rate		Basic Fee 37 C.F.R. § 1.16(a) \$ 710.00
Total						
Claims (37 C.F.R. § 1.16(c))	15	- 20 =	0	×	\$ 18.00	0
Independent						
Claims (37 C.F.R. § 1.16(b))	3	- 3 =	0	×	\$ 80.00	0
Multiple dependent claim(s), If any (37 C.F.R. § 1.16(d))						
				+	\$ 270.00	

- ☐ Amendment cancelling extra claims is enclosed.  
☒ Amendment deleting multiple-dependencies is enclosed.  
☐ Fee for extra claims is not being paid at this time.

NOTE: If the fees for extra claims are not paid on filing they must be paid or the claims cancelled by amendment, prior to the expiration of the time period set for response by the Patent and Trademark Office in any notice of fee deficiency. 37 C.F.R. § 1.16(d).

Filing Fee Calculation \$ 710.00

B. ☐ Design application  
(\$ 320.00 - 37 C.F.R. § 1.16(f))

Filing Fee Calculation \$

C. ☐ Plant application  
(\$ 490.00 - 37 C.F.R. § 1.16(g))

Filing fee calculation \$

11. Small Entity Statement(s)

- ☐ Statement(s) that this is a filing by a small entity under 37 C.F.R. § 1.9 and 1.27 is (are) attached.

**WARNING:** "Status as a small entity must be specifically established in each application or patent in which the status is available and desired. Status as a small entity in one application or patent does not affect any other application or patent, including applications or patents which are directly or indirectly dependent upon the application or patent in which the status has been established. The refiling of an application under § 1.53 as a continuation, division, or continuation-in-part (including a continued prosecution application under § 1.53(d)), or the filing of a reissue application requires a new determination as to continued entitlement to small entity status for the continuing or reissue application. A nonprovisional application claiming benefit under 35 U.S.C. § 119(e), 120, 121, or 365(c) of a prior application, or a reissue application may rely on a statement filed in the prior application or in the patent if the nonprovisional application or the reissue application includes a reference to the statement in the prior application or in the patent or includes a copy of the statement in the prior application or in the patent and status as a small entity is still proper and desired. The payment of the small entity basic statutory filing fee will be treated as such a reference for purposes of this section." 37 C.F.R. § 1.28(a)(2).

**WARNING:** "Small entity status must not be established when the person or persons signing the . . . statement can unequivocally make the required self-certification." M.P.E.P., § 509.03, 6th ed., rev. 2, July 1996 (emphasis added).

(complete the following, if applicable)

- ☐ Status as a small entity was claimed in prior application  
\_\_\_\_\_ / \_\_\_\_\_, filed on \_\_\_\_\_, from which benefit  
is being claimed for this application under:

35 U.S.C. § ☐ 119(e),  
☐ 120,  
☐ 121,  
☐ 365(c),

and which status as a small entity is still proper and desired.

- ☐ A copy of the statement in the prior application is included.

Filing Fee Calculation (50% of A, B or C above)

\$ \_\_\_\_\_

**NOTE:** Any excess of the full fee paid will be refunded if small entity status is established and a refund request are filed within 2 months of the date of timely payment of a full fee. The two-month period is not extendable under § 1.136. 37 C.F.R. § 1.28(a).

12. Request for International-Type Search (37 C.F.R. § 1.104(d))

(complete, if applicable)

- ☐ Please prepare an international-type search report for this application at the time when national examination on the merits takes place.

13. Fee Payment Being Made at This Time

☐ Not Enclosed

☐ No filing fee is to be paid at this time.

*(This and the surcharge required by 37 C.F.R. § 1.16(e) can be paid subsequently.)*

☒ Enclosed

☒ Filing fee

\$ 710.00

☒ Recording assignment

(\$40.00; 37 C.F.R. § 1.21(h))

(See attached "COVER SHEET FOR  
ASSIGNMENT ACCOMPANYING NEW  
APPLICATION".)

\$ 40.00

☐ Petition fee for filing by other than all the  
inventors or person on behalf of the inventor  
where inventor refused to sign or cannot be  
reached

(\$130.00; 37 C.F.R. §§ 1.47 and 1.17(l))

\$ \_\_\_\_\_

☐ For processing an application with a  
specification in

a non-English language

(\$130.00; 37 C.F.R. §§ 1.52(d) and 1.17(k))

\$ \_\_\_\_\_

☐ Processing and retention fee

(\$130.00; 37 C.F.R. §§ 1.53(d) and 1.21(l))

\$ \_\_\_\_\_

☐ Fee for international-type search report

(\$40.00; 37 C.F.R. § 1.21(e))

\$ \_\_\_\_\_

NOTE: 37 C.F.R. § 1.21(l) establishes a fee for processing and retaining any application that is abandoned for failing to complete the application pursuant to 37 C.F.R. § 1.53(f) and this, as well as the changes to 37 C.F.R. §§ 1.53 and 1.78(a)(1), indicate that in order to obtain the benefit of a prior U.S. application, either the basic filing fee must be paid, or the processing and retention fee of § 1.21(l) must be paid, within 1 year from notification under § 53(f).

Total fees enclosed

\$ 750.00

14. Method of Payment of Fees

☒ Check in the amount of \$ 750.00

☐ Charge Account No. \_\_\_\_\_ in the amount of  
\$ \_\_\_\_\_

A duplicate of this transmittal is attached.

NOTE: Fees should be itemized in such a manner that it is clear for which purpose the fees are paid. 37 C.F.R. § 1.22(b).



**15. Authorization to Charge Additional Fees**

**WARNING:** If no fees are to be paid on filing, the following items should not be completed.

**WARNING:** Accurately count claims, especially multiple dependent claims, to avoid unexpected high charges, if extra claim charges are authorized.

- ☒ The Commissioner is hereby authorized to charge the following additional fees by this paper and during the entire pendency of this application to Account No. 16-1350.

☒ 37 C.F.R. § 1.16(a), (f) or (g) (filing fees)

☒ 37 C.F.R. § 1.16(b), (c) and (d) (presentation of extra claims)

**NOTE:** Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims cancelled by amendment prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency (37 C.F.R. § 1.16(d)), it might be best not to authorize the PTO to charge additional claim fees, except possibly when dealing with amendments after final action.

☒ 37 C.F.R. § 1.16(e) (surcharge for filing the basic filing fee and/or declaration on a date later than the filing date of the application)

☒ 37 C.F.R. § 1.17(a)(1)-(5) (extension fees pursuant to § 1.136(a)).

☒ 37 C.F.R. § 1.17 (application processing fees)

**NOTE:** ". . . A written request may be submitted in an application that is an authorization to treat any concurrent or future reply, requiring a petition for an extension of time under this paragraph for its timely submission, as incorporating a petition for extension of time for the appropriate length of time. An authorization to charge all required fees, fees under § 1.17, or all required extension of time fees will be treated as a constructive petition for an extension of time in any concurrent or future reply requiring a petition for an extension of time under this paragraph for its timely submission. Submission of the fee set forth in § 1.17(a) will also be treated as a constructive petition for an extension of time in any concurrent reply requiring a petition for an extension of time under this paragraph for its timely submission." 37 C.F.R. § 1.136(a)(3).

☐ 37 C.F.R. § 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 C.F.R. § 1.311(b))

**NOTE:** Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the notice of allowance. 37 C.F.R. § 1.311(b).

**NOTE:** 37 C.F.R. § 1.28(b) requires "Notification of any change in status resulting in loss of entitlement to small entity status must be filed in the application . . . prior to paying, or at the time of paying, . . . the issue fee. . . ." From the wording of 37 C.F.R. § 1.28(b), (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.

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**16. Instructions as to Overpayment**

NOTE: "... Amounts of twenty-five dollars or less will not be returned unless specifically requested within a reasonable time, nor will the payer be notified of such amounts; amounts over twenty-five dollars may be returned by check or, if requested, by credit to a deposit account." 37 C.F.R. § 1.26(a).

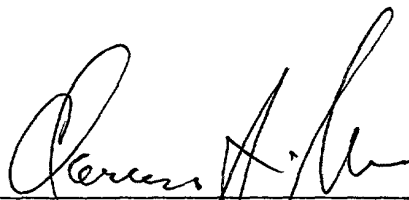
- ☒ Credit Account No. 16-1350  
☐ Refund

SEND ALL CORRESPONDENCE TO:  
Clarence A. Green, Reg. No.: 24,622  
PERMAN & GREEN, LLP  
425 Post Road  
Fairfield, Connecticut 06430

Reg. No. 24,622

Tel. No. ( 203) 259-1800

Customer No. 2512



SIGNATURE OF PRACTITIONER

Clarence A. Green

(type or print name of attorney)

PERMAN & GREEN, LLP

P.O. Address

425 Post Road, Fairfield, Connecticut 06430

000211 089160

☐ **Incorporation by reference of added pages**

*(check the following item if the application in this transmittal claims the benefit of prior U.S. application(s) (including an international application entering the U.S. stage as a continuation, divisional or C-I-P application) and complete and attach the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED)*

- ☐ Plus Added Pages for New Application Transmittal Where Benefit of Prior U.S. Application(s) Claimed

Number of pages added \_\_\_\_\_

- ☐ Plus Added Pages for Papers Referred to in Item 4 Above

Number of pages added \_\_\_\_\_

- ☐ Plus added pages deleting names of inventor(s) named in prior application(s) who is/are no longer inventor(s) of the subject matter claimed in this application.

Number of pages added \_\_\_\_\_

- ☐ Plus "Assignment Cover Letter Accompanying New Application"

Number of pages added \_\_\_\_\_

☒ **Statement Where No Further Pages Added**

*(if no further pages form a part of this Transmittal, then end this Transmittal with this page and check the following item)*

- ☒ This transmittal ends with this page.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Express Mail No.: EL627420983US

In re Application of: LIPPONEN et al.

SERIAL NUMBER:

EXAMINER:

FILING DATE: Herewith

ART UNIT:

TITLE: ELECTRONIC DEVICE AND A METHOD IN AN ELECTRONIC DEVICE

ATTORNEY DOCKET NO.: 460-009934-US(PAR)

The Commissioner of Patents and Trademarks

Washington, D.C. 20231

PRELIMINARY AMENDMENT

Dear Sir:

Please amend the above-identified, enclosed patent application as follows:

IN THE CLAIMS:

Please amend Claims 4 and 6 as shown below.

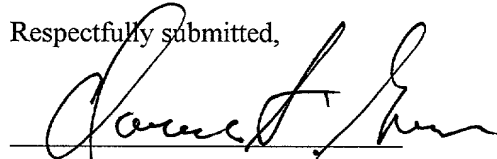
Claim 4, lines 1 and 2, delete "any one of the claims 1, 2 or 3" and insert --claim 1--.

Claim 6, lines 1 and 2, delete "any one of the claims 1, 2 or 3," and insert --claim 1--.

Remarks

Please enter this preliminary amendment prior to calculation of the fees.

Respectfully submitted,



Clarence A. Green, Reg. No. 24,622  
Perman & Green, LLP  
425 Post Road  
Fairfield, CT 06430  
(203) 259-1800  
Customer No. 2512



Date

# Electronic device and a method in an electronic device

5 This invention relates to an electronic device according to the preamble of claim 1. This invention also relates to a method in an electronic device according to the preamble of claim 9. This invention also relates to a keyboard of an electronic device according to the preamble of claim 15.

10 In order to improve mobile communications available for people, various mobile communication equipment, such as cordless phones and mobile stations, have been provided in the prior art. A very popular piece of mobile communication equipment is the mobile station, which can be, for instance, a digital mobile station operating in a mobile communication system based on a cellular network according to the  
15 GSM standard (Global System for Mobile Communications).

20 Various devices for saving information, such as notebook computers, small hand-held computers or PDA (Personal Digital Assistant) devices are also known in the prior art. These devices can be used to save information given by the user, such as calendar data, notes, addresses and telephone numbers. Input of information in these devices usually takes place by means of a keyboard, but it is also possible to save textual information in some devices by writing it directly to a touch sensitive display by means of a stylus, for example. The performance of  
25 these devices is continuously increasing, and they already include many properties known from PC devices (Personal Computers). Extension cards according to the PCMCIA (Personal Computer Memory Card International Association) standard are available for some devices for coupling these devices to mobile stations, for  
30 example. Then it is possible to use PDA devices, for example, by means of radio waves, to send and receive telefax messages, short messages (SMS, Short Message Service) and other text files wirelessly. In this explanation, a PDA device means a device according to the above description.

There are also known devices in which the operations of a mobile communication device and a PDA device have been combined. One such known device is the Nokia Communicator 9110, by which it is possible to connect to the Internet, use radiotelephone functions, such as receiving a call and selecting a number, and receive telefax messages, for example. The properties of mobile communication devices, such as mobile stations, are continuously increasing and usually include operations for saving the telephone numbers of persons and companies, for example. In this specification, the term mobile station means a mobile station which includes operations of the above described PDA device or a corresponding device.

In the present mobile stations as those described above and other electronic devices with a keyboard, the major problem in implementation is the large number of connection lines especially when the keyboard includes a large number of keys, such as the numerical keys and the alphabetical keys. The Nokia 9110 Communicator device, for instance, has both a numerical keyboard and an alphabetical keyboard essentially like the one in computers, but smaller. The operation of a keyboard is relatively simple, but because of the large number of connection lines, the application specific integrated circuit, ASIC, becomes rather large, and the increase in the price of the circuit also increases the price of the complete device.

Each connection line requires the implementation of a connection element on the application specific integrated circuit. This connection element uses a lot more of the surface area of the semiconductor chip used for the implementation of the application specific integrated circuit than, for example, the implementation of other logic operations. Thus the number of connection lines increases the surface area of the semiconductor chip and, on the other hand, remarkably limits the number of functions that can be implemented on the ASIC. The number of connection lines of the ASICs used in mobile stations has not changed much between different generations. At the same time, the manufacturing technology of the application specific integrated circuits has developed from the line width of 0.55  $\mu\text{m}$  to the line width of 0.18

$\mu\text{m}$ , and the packing density of the logic has become 16 times higher. Because similar development will probably continue, the connection lines will form a more considerable limitation for the implementation of application specific integrated circuits.

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Each keyboard connection line coupled to an application specific integrated circuit must be protected against an electrical static discharge (ESD). A keyboard is very sensitive to problems caused by an electrical static discharge. Because of this, there have been problems with electrostatic protection of the keyboard in the design of mobile stations including PDA properties. With the present application specific integrated circuits, which have a line width of 0.25-0.35  $\mu\text{m}$ , it is not possible to implement sufficient electrostatic protection in the application specific integrated circuit internally, but the protection must be realized with components external to the application specific integrated circuit. This again results in the situation that the components that protect from an electrostatic discharge increase the surface area and price of the circuit board. The situation will become even more difficult in the future when the manufacturing technologies of application specific integrated circuits develop towards even more narrow line widths.

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In mobile stations in which the keyboard is implemented in a sliding or turning element of the mobile station, the problem is the realization of the interface between the mobile station and the keyboard, because a prior art keyboard of a mobile communication device implemented with a circuit board requires more than ten separate signals. The more signals have to be taken over this interface, the more complicated, more expensive and more vulnerable to errors the implementation becomes. In addition, the keyboards implemented by means of a circuit board according to the above have the problem that they are relatively thick.

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A known electronic device like the one described above, in which an attempt has been made to solve the above described problems, has been presented in the US Patent No. 5,584,054. An electronic device

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comprises a touch sensitive display disposed in the body housing element, whereby the operations of the electronic device can be controlled by touching the activation areas of the display. The touch sensitive display also comprises a display area in which information used in mobile stations, such as telephone numbers, can be shown. In connection with the touch sensitive screen, there is provided a rigid cover arranged as movable with a hinge, which can be turned in a closed position over the touch sensitive display. In apertures made in the cover, there are also arranged mechanical activation elements, or keys, so that when the activation elements are depressed when the cover is in the closed position, they touch the activation areas of the touch sensitive display and thus transmit the depression to the display for activating the functions of the device. The electronic device presented in the US Patent 5,584,054 operates as a mobile station when the cover is in the closed position. The electronic device also operates as a PDA device when the cover is in the opened position, whereby the operations of the electronic device can be controlled by touching the activation areas of the display directly with a finger or a pointed object resembling a pen. When the cover is in the opened position, depressing the keys has no effect, because in this position of the cover the movement of the keys does not extend to the touch sensitive screen. The hinge of the cover of the electronic device is provided with a switch, which recognizes the position of the cover and controls the operation of the electronic device. The cover also functions as a protective cover for the touch sensitive display. The prior art technology also provides mobile stations with a rigid, level, non-transparent cover, which protects the keyboard disposed in the body of the mobile station and which can be opened and closed. The cover is often provided with an opening, through which the display or display area of the mobile station can be read. Often the cover also includes the microphone of the mobile station, whereby the cover must be opened for the duration of the phone call.

In an electronic device according to the invention described above it is not possible to use the keyboard and the whole display at the same time. When the cover is closed for using the keyboard, only a small



portion of the possible display area is available for use. When a part of the display area is reserved as activation areas, it is not possible to present as much information on the display as in electronic devices with a separate keyboard and a display. When the cover of the electronic device is open and the electronic device is used by means of the touch-screen display, the whole display area is still not in use, because part of the display area is reserved as activation areas. In addition, it is difficult for the user to get any other feedback from pressing the activation area than possible changes on the display.

It is an object of this invention to provide an electronic device in which the whole display area and keyboard are available for use at the same time. According to the invention, this object can be achieved by implementing the keyboard instead of the display as a separate element which can be exposed by sliding or turning. Another object of the invention is to achieve an electronic device, in which the keyboard interface is much simpler than in the conventional solution. According to the invention, this object can be achieved by implementing the keyboard by means of a touch sensitive element. A third object of the invention is to provide a keyboard of an electronic device, which gives the user immediate feedback for the success of the depression of a key. According to the invention, this object can be achieved by placing a conventional keyboard mat or membrane over the touch sensitive element. A fourth object of the invention is to achieve a keyboard element of an electronic device, which would be considerably thinner compared to the prior art solutions. According to the invention, this object can be achieved by implementing the keyboard by means of a touch sensitive element.

To put it more accurately, the electronic device according to the invention is characterized in what is set forth in the characterizing part of claim 1. In addition, the method according to the invention is characterized in what is set forth in the characterizing part of claim 9. In addition, the keyboard according to the invention is characterized in what is set forth in the characterizing part of claim 15.

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The present invention provides considerable advantages as compared to the prior art solutions. When the electronic device has a keyboard disposed in a separate element, which is exposed by sliding or turning, it is not necessary to reserve certain areas of the display as activation areas for the keyboard, but the entire display area is available for displaying the information to be presented. When the keyboard is implemented with a touch sensitive element, the interface between the keyboard and the body of the electronic device becomes much simpler, and the number of I/O (input/output) signals can be reduced to two at the best, whereby the construction becomes much simpler, cheaper and less vulnerable to damage. When a prior art keyboard mat has been installed on the touch sensitive element, the user receives a good feedback when depressing a key, which is a very important property of a user interface. Especially people with large fingers will find it much easier to use the small keys of mobile stations correctly, if the user has a good tactile feel of the keyboard. A good tactile feel can be provided for the user by using a keyboard mat similar to the conventional type on top of the touch sensitive element.

In the following, the invention will be described in more detail with reference to the accompanying drawings, in which

Figure 1 shows an electronic device according to a preferred embodiment of the invention, in which the keyboard is implemented in an element which slides out.

Figure 2 shows an electronic device according to Figure 1 seen from above and the keyboard element as pushed into the body of the device,

Figure 3 shows an electronic device according to Figure 1 as seen from the section A-A.

Figure 4 shows a schematic diagram of the electronic device and a preferred implementation of the touch sensitive element,

Figure 5 shows an electronic device according to a preferred embodiment of the invention, in which the exposable keyboard is implemented in a turning element.

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Figure 6 shows the electronic device according to Figure 5 seen from above and the keyboard element in the closed position.

A keyboard of an electronic device according to the invention can be used, for example, in PDA devices, portable computers and mobile stations. In this specification, a mobile station is used as an example of an electronic device. Figure 1 shows a mobile station 1 according to the invention, which comprises a keyboard element 3 and a body housing element 2, the front panel 2a of which includes a display 5, a microphone 6, an earphone 7 and possibly one or more function keys 8. It is clear that, for instance, some of the function keys 8 can also be placed in an other part of the housing than the front panel 2a. The keyboard element 3 includes the keyboard 4 of the mobile station. In addition, the body housing element includes a sensor element 27, such as a switch, which recognizes if the keyboard element 3 is out or pushed into the body housing element 2.

The display 5 is preferably a depression responsive touch sensitive liquid crystal display (LCD), which also recognizes a touch with a weak intensity. The liquid crystal display is provided with, for instance, a touch sensitive membrane or other corresponding and well known technology, which also recognizes the touching point. When the keyboard element is not exposed, or it is pushed into the body 2 as shown in Figure 2, this touch sensitive display 5 preferably comprises a group 9 of activation areas for activating the telephone functions of the device 1 by touching the activation areas 13 and preferably at least one display area 10 for presenting variable information, such as a telephone number, the state of the battery 11 of the device and the strength of the signal 12 received by the device 1. The user activates the operations normally by depressing the keys lightly with a finger, but the depression can also be carried out with a pointed object or the like, when the

touch-recognition technology used allows it. The points to be depressed, or the activation areas 13 for activating different telephone functions of the device 1 can also be shown by rectangles, circles or corresponding figures drawn on the display 5 by the control program of the device 1, combined with symbols or other markings in connection with the figures, when required. The size, shape and location of these activation areas 13 and the display area 10 can vary. In addition, there can be many separate display areas 10 on the display.

- 10 The telephone functions mentioned above are preferably functions which can be performed in conventional telephones with a memory for telephone numbers and the corresponding names. Functions like this are calling, answering an incoming call and retrieving a telephone number from the memory. The number memory can be browsed, for example, by function keys 8 or by activation areas 13 created for browsing.

- Other functions that are well known from conventional mobile stations and PDA devices, such as handling text messages, saving telephone numbers, keeping a calendar and selecting a ringing tone, are preferably performed when the keyboard element 3 is drawn out from the bottom of the body housing element 2. Then the user has a display area 10 with the full size of the display 5 available for the presentation of information and a good keyboard 4 for the input of information. It is also possible that part of the display 5 is reserved for the use of the activation areas 9, whereby only part of the area of the display 5 remains for the use of the display area 10. However, when the keyboard element is drawn out, the need for activation areas is smaller, and thus more room remains for the display area than when the keyboard element 3 is pushed into the body housing element 2.

- Figure 3 shows a cross-section of a keyboard element 3 of a mobile station according to a preferred embodiment of the invention. This keyboard element 3 preferably comprises a housing element 14, a touch sensitive element 19 known per se and a keyboard mat 16 known per se, which in turn consists of keys 15a, 15b, spring means 17 and a

support means 18. The spring means is preferably made of some elastic material, and it is fastened to both the support means and the key, thus tying the key and the support means elastically together. The purpose of the spring means is to enable the mobility of the keys so that the key can be pressed down 15b, and when the key is released, it returns up 15a. The support means 18 is preferably a plate made of rigid material with holes for each key 15a, 15b supported by a spring means 17. The support means 18 is fastened at the edges securely to the housing 14 of the keyboard element so that when the keys are up 15a, the touching element 20 of each key is essentially at the same, specified distance from the touch sensitive element. This distance can be, for example, 0.3-1.0 mm.

The implementation of the keyboard 4 is such that a keyboard plate 16 is placed over the touch sensitive element 19. This keyboard plate is installed over the touch sensitive element as fixed. The keyboard plate is preferably a keyboard mat, whereby the user gets a good tactile feel of the keyboard and as good feedback as possible when a key is depressed. Then an experienced writer can write merely on the basis of the feel and looking at the writing on the display. In the scope of this invention, the keyboard plate 16 can also be a membrane (not shown), preferably a bubble membrane, on which key markings have been made for showing the places of the keys 15a, 15b. An alternative way for manufacturing the keyboard plate 16 is to form the keyboard plate 16 of separate keys and a supporting plate (not shown). One more alternative is to manufacture the keyboard plate 16 with two-phase injection moulding. Then the frame is made of rigid material, such as rigid plastic, and in the second phase its holes are filled by injection moulding with some softer and more elastic material, such as a soft plastic mixture, thus forming the keys (15a, 15b) so that the frame and the keys form a solid entity.

The touch sensitive element 19 can be implemented so, for instance, that it is preferably formed of two essentially rectangular membranes of the same size 19a, 19b (Figure 4), which are arranged at a specified distance from each other and preferably essentially parallel. The

membrane on top, or the one on which the touch is targeted, is made of some resistive material. On the upper membrane there are two conductors Xin, Yin connected on adjacent sides, and the other sides are connected to the 0 potential. On the lower membrane there are also conductors Xout and Yout connected on adjacent sides. Xin and Xout are connected on the same sides of the membranes 19a, 19b and essentially at the same points. Correspondingly, Yin and Yout are connected on the same sides of the membranes 19a, 19b and essentially at the same points.

When a key is pressed down 15b, the touching element 20 presses the touch sensitive element 19 below it with such a great strength that the upper membrane 19a touches the surface of the lower membrane 19b, and thus a contact is created between the membranes. An A/D converter 22b detects the depression by examining at times, which is called polling, whether a key has been depressed. For the duration of the polling, a constant voltage is preferably switched from the D/A converter 22a to the Xin line, for example, and the voltage of the Xout line is measured. If the voltage differs essentially from zero, a key has been depressed, whereupon the X coordinate is calculated from the voltage value. The voltage in the Xout line is the higher the closer the contact point is to the edge to which the conductors Xin and Xout are connected. After this, the Y coordinate is received in a corresponding manner preferably by switching a constant voltage to the Yin line from the D/A converter 22a and by measuring the voltage of the Yout line. The voltage in the Yout line is also the higher the closer the contact point is to the edge to which the conductors Yin and Yout are connected. For the duration of specifying the X coordinate, Yin is switched to a high-impedance mode to prevent it from distorting the measurement result. Correspondingly, Xin is switched to a high-impedance mode when the Y coordinate is being specified.

Another alternative method for manufacturing a touch sensitive element 19 is to use an EMFi membrane (not shown). The EMFi membrane consists of a porous polypropylene membrane, which is coated with an electricity conducting metal layer. The pores of the polypropylene

membrane have an electric charge, whereby the force effect targeted at the EMFi membrane presses the porous polypropylene membrane, which causes a change in the intensity of the electric field of the EMFi membrane. This again causes a transfer of charges between metal surfaces. This transfer of charges can be detected by switching the metal surfaces to an external electrical circuit, in which the current strength in this circuit is measured.

Because in a mobile station 1 according to a preferred embodiment of the invention, the keyboard 4 is implemented by using a touch sensitive element 19, there is much more room left on the circuit board (not shown) for other components. Alternatively, the circuit board can be made thinner or its size reduced considerably, whereby the manufacturing costs of the mobile station 1 are also substantially reduced. This is due to the fact that in the prior art implementations the keyboard is normally constructed on a circuit board. In a mobile station 1 according to the invention, only four lines need to be drawn on the circuit board for the keyboard.

With a mobile station 1 according to a preferred embodiment of the invention, it is very easy to change the keyboard 4 to one with a different appearance, location, number or meaning of the keys 15a, 15b. This can be done by changing the desired keyboard mat 16 to the mobile station and by programming the coordinates and meaning of the keys in place of the old ones. It is also possible to save many different keyboard appearances to the memory 23 of the mobile station 1, whereby the keyboard can be changed by changing the keyboard mat 16 to the mobile station 1 and by selecting the setting corresponding to the keyboard mat 16 from the menu of the mobile station 1. This provides, among other things, the advantage that companies that manufacture mobile stations need not manufacture different mobile stations for each different language area, but the same model of a mobile station can be used in all the places where the same telecommunications standard is used. The manufacturers need to take the appearance of the keyboard 4 into account at the end of the manufacturing process by installing the correct keyboard mat 16 in the

mobile station and by selecting from the menu of the mobile station 1 the setting which corresponds to the keyboard mat 16 or by programming the coordinates and meaning of the keys in place of the old ones.

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The mobile station can also be implemented so that the keyboard element 3 is arranged in relation to the body housing element 2 as turning by means of at least one hinge 26 as shown in Figure 5. In this case the display 5 and the keyboard 4 are located preferably so that  
10 when the keyboard element 3 is in the closed position, or the keyboard element functions as protection for the display 3, the keyboard 4 is within the mobile station 1. In order to make it possible to use the telephone functions without turning the keyboard element out, another display 24 and another keyboard 25 are preferably arranged in the  
15 mobile station as shown in Figure 6. This other keyboard 25 preferably comprises only the keys needed for using all the telephone functions. The other display 24 is preferably such that all the necessary information for using the telephone functions can be shown on it.

20 It is clear that in practical applications, the mobile station 1 according to the invention can differ from the embodiments described above. For example, the mobile station 1 can be implemented so that the keyboard is disposed in the body housing element 2 and the display 5 in an exposable, sliding or turning display element. It is also possible to  
25 install both the keyboard 4 and the display in the body housing element 2, but then the size of the mobile station would become larger than in the embodiments described above.

30 The present invention is not limited to the above described embodiments only, but its details can be modified without departing from the scope defined by the attached claims.



Claims

1. An electronic device (1), which preferably comprises at least a keyboard (4), which keyboard comprises at least one key (15a, 15b) for controlling the functions of the electronic device (1), which keyboard (4) is arranged as a keyboard plate (16), **characterized** in that said keyboard (4) also comprises a touch sensitive element (19), that said keyboard plate (16) is arranged as fixed over the touch sensitive element (19) so that the depression of a key is arranged to be transmitted to the touch sensitive element essentially at the point of the key (15a, 15b), and that the electronic device (1) comprises means (21, 22b) for determining the point of depression in the touch sensitive element (19), whereby it is arranged to be determined on the basis of the determined point of depression which key (15a, 15b) has been depressed.
2. An electronic device (1) according to claim 1, **characterized** in that the keyboard plate (16) is a keyboard mat.
3. An electronic device (1) according to claim 1, **characterized** in that the keyboard plate (16) is a bubble membrane.
4. An electronic device (1) according to any one of the claims 1, 2 or 3, **characterized** in that it comprises a sliding keyboard element (3), in which the keyboard (4) is disposed.
5. An electronic device (1) according to claim 4, which comprises at least one body housing element (2), **characterized** in that the keyboard element (3), which has a first and a second extreme position, is arranged as sliding between the first and the second extreme position, and in the first extreme position the keyboard element (3) is preferably under the body housing element (2) so that the keyboard (4) is at least partly invisible, and in the second extreme position the keyboard element (3) is preferably so that the keyboard (4) is essentially entirely exposed.

6. An electronic device (1) according to any one of the claims 1, 2 or 3, which comprises at least one body housing element (2), **characterized** in that it comprises a keyboard element (3) arranged as turning in relation to the body housing element (2), in which keyboard element the keyboard (4) is disposed.
7. An electronic device (1) according to claim 6, **characterized** in that the keyboard element (3), which has a first and a second extreme position, is arranged as turning between the first and the second extreme position, and in the first extreme position the keyboard element (3) is preferably placed over the body housing element (2) so that the keyboard element (3) functions as protection for the display (5) and the keyboard (4) is at least partly invisible, and in the second extreme position the keyboard element is preferably so that the keyboard (4) and the display (5) are essentially entirely exposed.
8. An electronic device (1) according to claim 7, **characterized** in that another display (24) and another keyboard (25) are arranged in it for activating one or more functions of the electronic device (1) preferably when the keyboard element (3) is in said first extreme position.
9. A method for recognizing the depression of a key (15a, 15b) of the keyboard (4) of an electronic device (1), which keyboard (4) is used for controlling the functions of the electronic device (1), in which method the keys are formed into a keyboard plate (16), **characterized** in that the keyboard (4) is formed of a touch sensitive element (19), over which the keyboard plate (16) is arranged as fixed so that the depression of a key is transmitted to the touch sensitive element (19) essentially at the point of a key (15a, 15b), and that the point of depression in the touch sensitive element (19) is determined in the electronic device (1), whereby on the basis of the determined point of depression it is determined which key (15a, 15b) has been depressed.

10. A method according to claim 9, **characterized** in that the electronic device (1) is provided with a sliding keyboard element (3), in which the keyboard (4) is disposed.
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11. A method according to claim 10, in which at least one body housing element (2) is formed in the electronic device, **characterized** in that the keyboard element (3), which has a first and a second extreme position, slides between the first and the second extreme position, and in the first extreme position the keyboard element (3) is preferably under the body housing element (2) so that the keyboard (4) is at least partly invisible, and in the second extreme position the keyboard element (3) is preferably so that the keyboard (4) is essentially entirely exposed.
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12. A method according to claim 9, in which the electronic device (1) is provided with at least one body housing element (2), **characterized** in that the implementation of the electronic device (1) includes a keyboard element (3) turning in relation to the body housing element (2), in which keyboard element the keyboard (4) is disposed.
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13. A method according to claim 12, **characterized** in that the keyboard element (3), which has a first and a second extreme position, turns between the first and the second extreme position, and in the first extreme position the keyboard element (3) is preferably placed over the body housing element (2) so that the keyboard element (3) functions as protection for the display (5) and the keyboard (4) is at least partly invisible, and in the second extreme position the keyboard element (3) is preferably so that the keyboard (4) and the display (5) are essentially entirely exposed.
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14. A method according to claim 13, **characterized** in that the electronic device (1) is provided with another display (24) and another keyboard (25) for activating one or more functions of the
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electronic device (1) preferably when the keyboard element (3) is in said first extreme position.

- 5 15. A keyboard (4) of an electronic device (1), which comprises at least one key (15a, 15b) for controlling the functions of the electronic device (1), which keyboard (4) is arranged as a keyboard plate (16), **characterized** in that said keyboard (4) also comprises a touch sensitive element (19), and that said keyboard plate (16) is arranged as fixed over the touch sensitive element (19) so that the depression of a key is arranged to be transmitted to the touch sensitive element essentially at the point of the key (15a, 15b), whereby it is arranged to be determined on the basis of the determined point of depression which key (15a, 15b) has been depressed.
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(57) Abstract:

An electronic device (1) comprises preferably at least a keyboard (4), which comprises at least one key (15a, 15b) for controlling the functions of an electronic device (1). This keyboard (4) is arranged as a keyboard plate (16). Said keyboard (4) is implemented so that it also comprises a touch sensitive element (19), over which said keyboard plate (16) is arranged so that the depression of a key is arranged to be transmitted to a touch sensitive element (19) essentially at the point of a key (15a, 15b). In addition, the electronic device (1) comprises means (21, 22b) for determining the point of depression from the touch sensitive element (19), whereby on the basis of the determined point of depression it is determined which key (15a, 15b) has been depressed.

Fig. 1

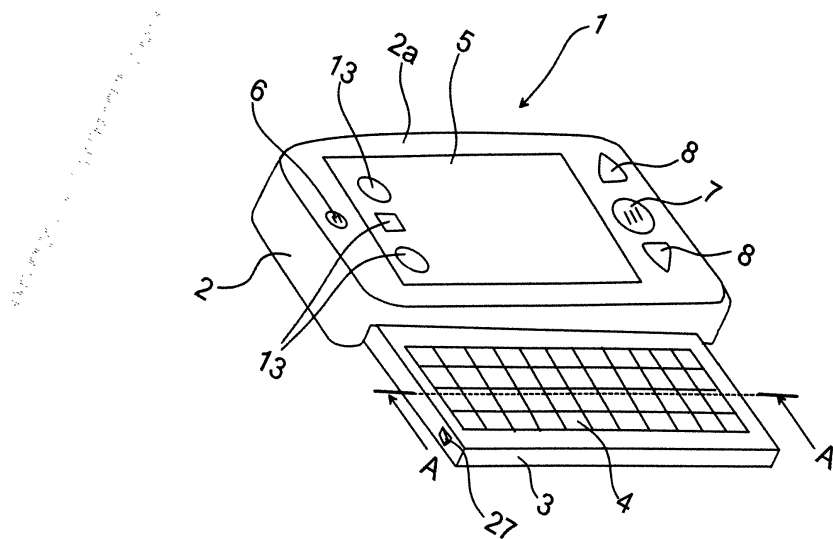


Fig. 1

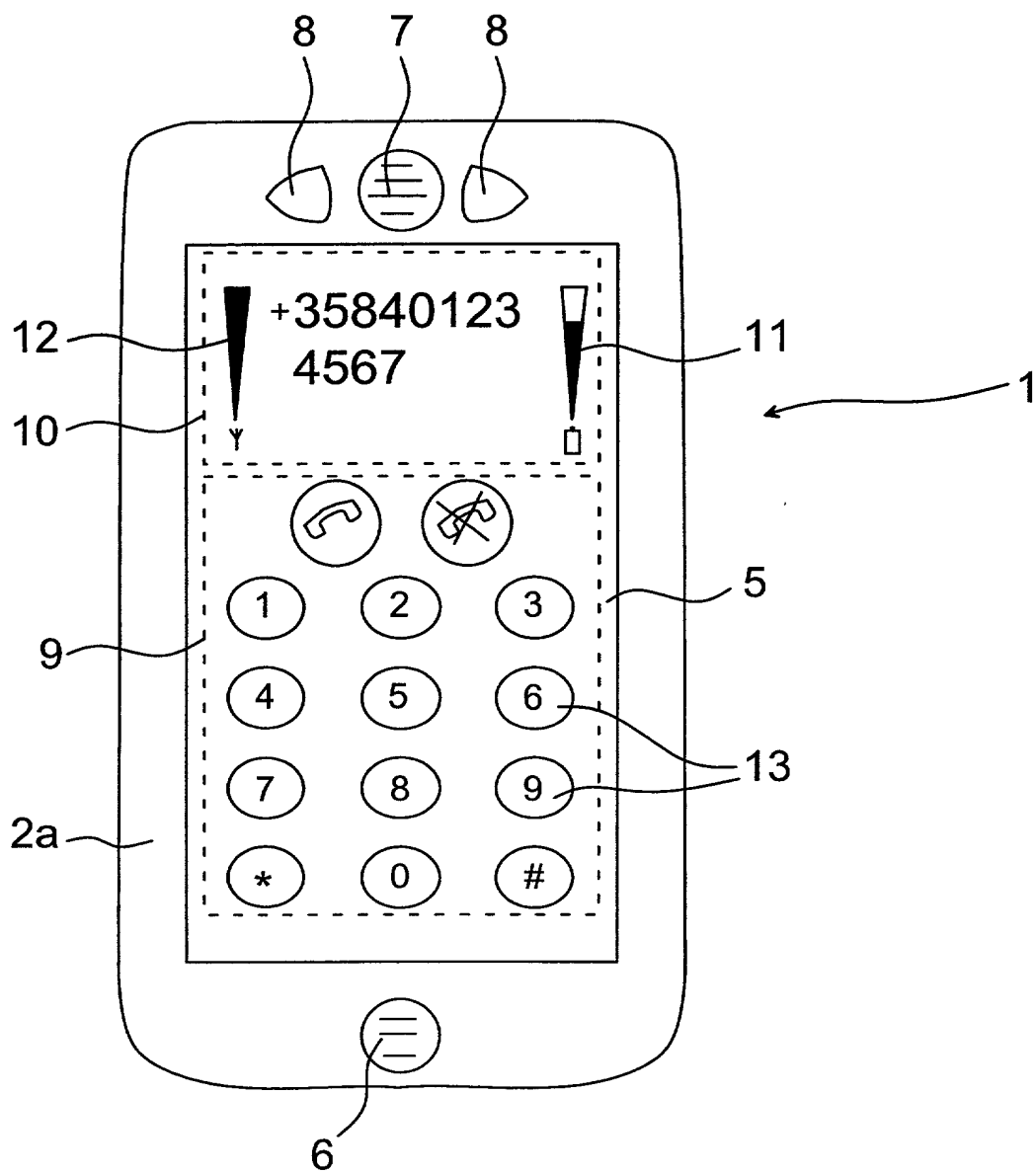


Fig. 2

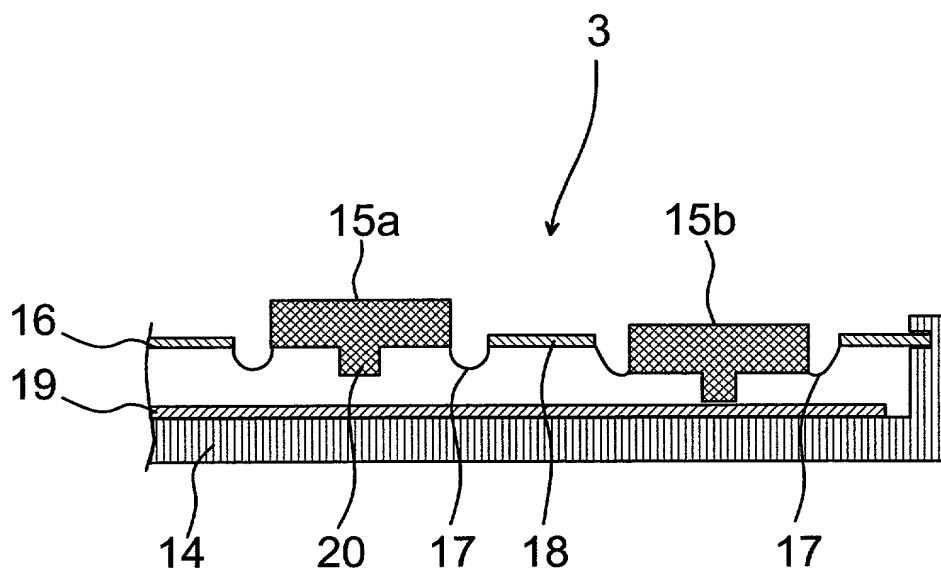


Fig. 3





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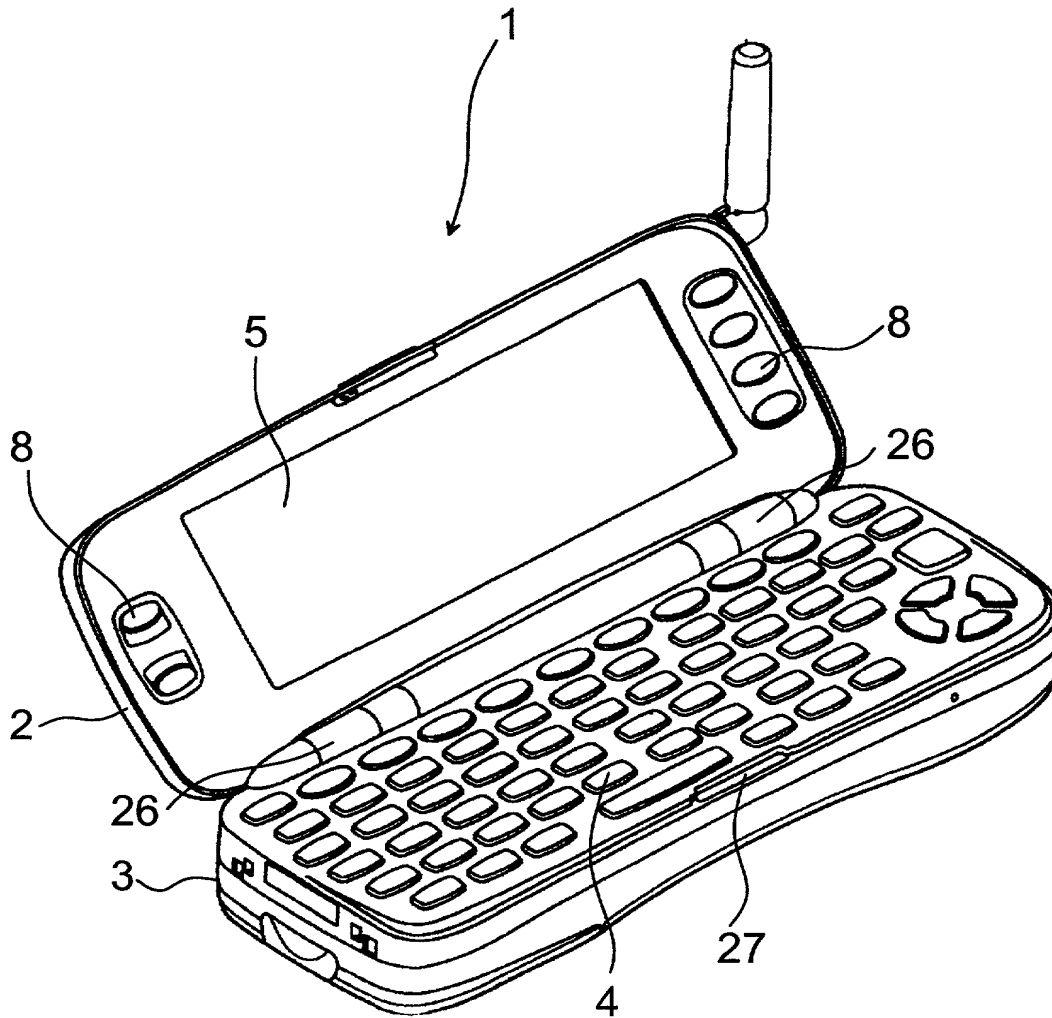
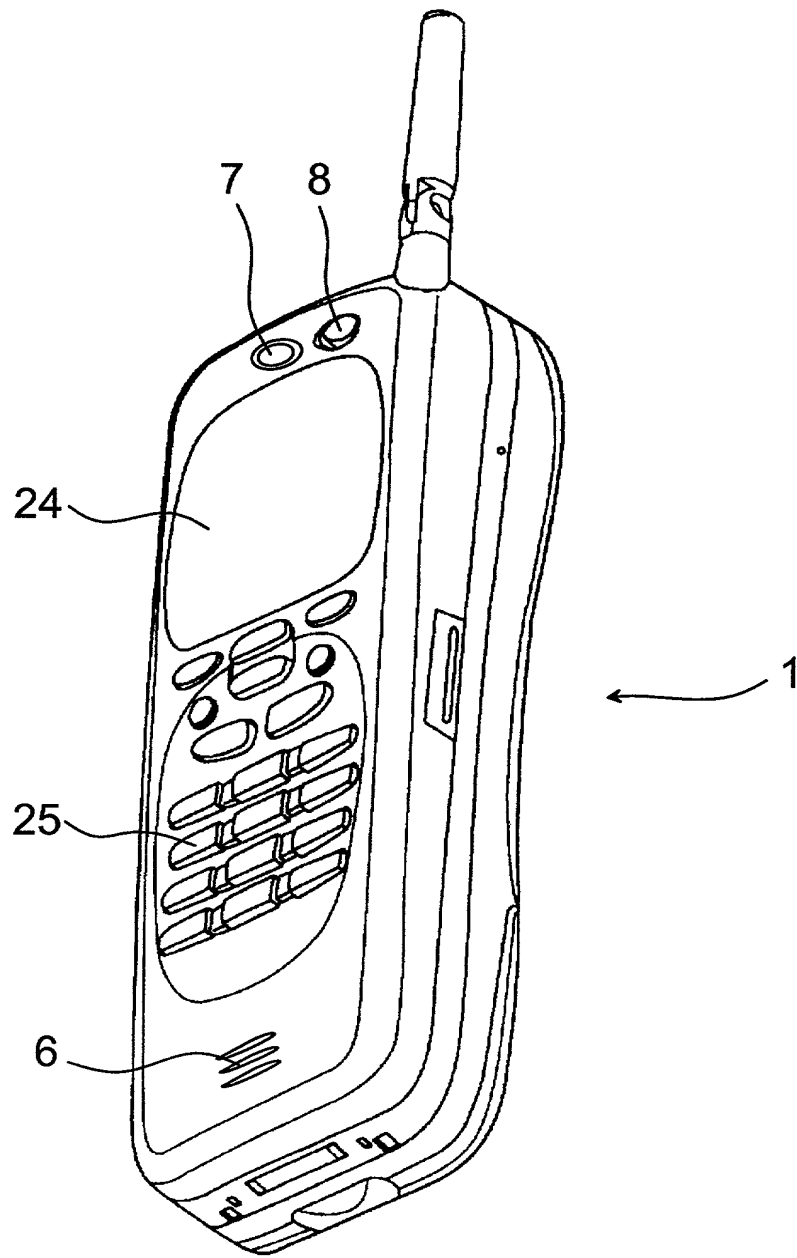


Fig. 5

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**Fig. 6**